How is ATP synthesized?

The universal currency of free energy in biological system, ATP, is synthesized from ADP and inorganic phosphate. The reaction is catalysed by F_1F_0 ATP synthase which is a complex multi subunit protein machinery and utilizes a transmembrane proton gradient. ATP synthesis is one of the key reactions in biological systems and is also one of the most complex ones involving several steps. It was therefore interesting to read the hypothesis of Nath, Rohatgi and Saha (*Curr. Sci.*, 2000, **78**, 23–27) on the catalytic cycle of this reaction. Almost simultaneously, Vinit Rastogi and Mark Girvin (*Nature*, 1999, **402**, 263–268) have examined the structural changes induced by the deprotonation of a specific amino acid (Asp 61) on the c-unit, which is involved in proton transport. This in turn is linked to the rotation of the a-subunit through an interaction between Asp 61 and Arg 210. Using sophisticated NMR techniques and chemical probes, the authors have proposed the structural and dynamic aspects of this reaction and have provided evidence which links proton translocation and the rotation.

It is clear from this work and others, that in unveiling how nature accomplishes complex biochemical steps, X-ray crystallography and NMR will continue to play vital and complementary roles. While the former is best suited to unravel complex molecular structures in atomic details (in this case the X-ray structure of the F_1 domain by Walker's group, *Nature*, 1994, **370**, 621–628), functional and dynamic information can be best explored through NMR techniques.

GIRJESH GOVIL

Department of Chemical Sciences,
Tata Institute of Fundamental Research,
Homi Bhabha Road,
Mumbai 400 005, India

Reflections on the Indian Science Congress

The 87th Session of the Indian Science Congress (ISC) was held in the sprawling grounds of University of Pune (PU) between 3rd and 7th January 2000.

Here I summarize what transpired at the earth system sciences (ESS) session and give some suggestions to improve the quality of future congresses in the light of some observations:

Earth system sciences

The ESS session comprised of ~ 35 presentations, including four from ISCA Young Scientists. The ESS commenced with the sectional President's (S. Acharya) talk on 'Some observations on parts of the banded iron-formations of Eastern India' and was followed by S. C. Sarkar's on 'Ore geology – today and tomorrow'. Prof. K. P. Rode Memorial lecture was delivered by S. K. Tandon who detailed the environmental and climate records of the Thar desert. The 5th foundation lecture of the Indian Geological Congress was given by A. Mookherjee on 'Crustal fluids and formation of mineral deposits'. O. P. Varma and M. Mukherjee individually detailed the exploration and exploitation of the platinum group of minerals in India. D. Banerjee highlighted the 'Precambrian–Cambrian Boundary' and the recent developments in their classifications. An interesting talk was on the possibility of plate tectonics in the Archean times by H. Upadhyay (Canada).

A session on 'Earth science education – problems and solutions' was an interactive session that discussed the present scenario of earth sciences, mainly dealing with the syllabus. The picture painted was quite dismal. It would be in the fitness of things if the suggestions made are forwarded to the UGC. Some concrete steps need to be evolved to make earth sciences fascinating so that students opt for it at the junior college itself. Students should be made more aware of geosciences, especially about its scope. Probably it is easier said than done in these days when they prefer the more profitable and exciting information technology-related subjects, but a serious attempt has to be made.

The ISCA Young Scientists award was bagged by V. V. S. S. Sarma of NIO, Goa for his presentation on 'Biogeochemical cycling of carbon in the Arabian Sea'; while two posters, 'Beach rocks along the coast of Maharastra' (by Duraiswamy and Thigale, PU) and 'InRidge: India's ridge research initiative' (by S. D. Iyer and R.. Mukhopadhyay, NIO) got the best poster awards.

Some observations and suggestions

Although it is heartening that a number of researchers participate at the ISCA sessions, a major lacuna seems to exist by the conspicuous absence of stalwarts and pioneers in various fields. What could be the viable reasons for this? In my opinion, and after having talked to a few delegates (at Pune and previously at Calcutta), the following points emerged.

1. The ISC being an annual affair, many people give it a pass with the thought that there is always the next year.
2. During January most of the places, especially the north, reel under severe winter which could put off people from travelling.
3. New results are not normally presented by most researchers, much of the work appears to be recycled.
4. There should be awards and rewards for the best papers (especially of new results) and speakers to encourage better participation. For the students too there should be prizes in the form of best papers and posters. The students can be divided into Master's level and above Master's and up to Post-Doctorate. For the latter, the ISCA Young Scientist Award could be considered and for the former,

some newer Award needs to be formulated.

5. The proceedings in the form of full papers (after peer review) should be published before the start of the next ISC. This would definitely boost the morale of the authors, especially of the youngsters.
6. In the case of ESS, a vast field is covered, encompassing both land geology and oceanography. It would probably be good to divide the ESS into two to cover the fields individually. Presently, most oceanographers skip the ESS since talks on land geology and techniques, are 'heavy' and non-connected to their research work.
7. Many a time the presentations leave much to be desired. For instance, the presenters put up slides and over head transparencies that are of very poor quality. Further, even some of the veterans in the field read out from the slides and OHP, instead of being little more extempore!
8. The ISC should be held once in two years. This could give time for the participants to better prepare and also help conserve national resources.

In the final analysis, it is seen that there is scope for changes at all levels. This is pertinent since preparations may have been initiated for the 2001 ISC show. Hence, this would be the right time to make amendments to improve the quality of the presentations and help attract more talents.

SRIDHAR D. IYER

National Institute of Oceanography,
Dona Paula,
Goa 403 004, India

NEWS

Another Indian optical observation of a gamma-ray burst afterglow from UPSO, Nainital

Gamma-ray bursts (GRBs), short and intense flashes of cosmic high energy (~ 100 keV – 1 MeV) photons, are unique phenomena. Their observed intense emission which often dominates the high-energy sky during their brief appearance has no parallel in all of astronomy. They are electromagnetically the most luminous events in the Universe as they release ~ $10^{51} - 10^{54}$ ergs or more of energy in a few seconds. The afterglow emission is similar in nature to the emission from supernova, but is more energetic by a few orders of magnitude. Following the naming sequence, nova and supernova, it is therefore appropriate to refer to the optical transient associated with GRBs as hypernova. GRBs have therefore become the crossroad of a network of knowledge, e.g. study of parent objects and probe of ancient Universe at a scale of distance deeper than that of supernovae. The origin of GRBs is still a mystery, though the phenomena were discovered in the late sixties. Multi-wavelength follow-up observations of the GRB afterglows at X-ray, optical and radio wavelengths have contributed significantly to our understanding of GRBs. They indicate that most likely all GRBs occur at cosmological distances.

For the first time in India successful observations of the optical transient of a GRB were carried out at the Uttar Pradesh State Observatory (UPSO), Manora Peak, Nainital on 23 January 1999 (Ram Sagar, *Curr. Sci.*, 1999, **76**, 865). After about 11 months, successful Indian optical observations of another GRB afterglow have again been carried out from UPSO.

An extremely intense 60-s long GRB was observed on 8 December 1999 at 04 : 36 : 52 UT (GCN 450). Its afterglow emission has been observed at several wavelengths located in radio, millimeter and optical regions at $\alpha_{2000} = 16^h\ 33^m\ 53.5^s$; $\delta_{2000} = +46°27'21''$. The optical observations of the GRB 991208 afterglow were made on December 1999 12.0, 13.0 and 14.0 UT in Cousins *I* passband using a 2048 × 2048 size CCD chip mounted at the f/13 Cassegrain focus of the 104 cm Sampurnanand telescope of UPSO, Nainital. As this GRB is located mostly in the daytime sky, making optical observations was a very difficult task. On all three nights, observations could be made just before the morning twilight at high air-mass (> 2) but in good photometric sky conditions. Long durations of nights at Nainital in December helped in carrying out observations at least for an hour or so. The results of UPSO observations are given in Table 1. On December 1999 14.0 UT, the object was very faint and was barely visible on the image for one hour exposure. We have therefore been unable to measure the magnitude from that image. The present observations in combination with the published ones have been used to derive decay of the optical transient of GRB 991208 in *R* and *I* passbands. The object is fading very fast and follows the following linear relations:

$$R(t) = 16.95(\pm 0.06) + 5.5(\pm 0.1) \log (t),$$

$$I(t) = 16.52(\pm 0.01) + 5.0\ (\pm 0.01) \log (t),$$

where t is the time in units of days after the trigger of the γ-ray event on December 1999 8.19 UT. The coefficients and their errors are obtained by fitting least square linear regressions to the observed magnitudes as a function of time. The flux decay of the optical transient is well characterized by a power law, $F(t) \propto t^{-\alpha}$, where $F(t)$ is the flux at time t and α is

Table 1. Results of UPSO observations of the GRB 991208 afterglow in *I* photometric passband

Time in UT	Magnitude
December 1999	
12.02	19.4 ± 0.18
13.00	19.9 ± 0.14
14.00	> 20